TF16Z-03

TF16Z-03

F-16

TRAINING MANUAL

RIVETING SOLID-SHANK CONVENTIONAL RIVETS

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DISTRIBUTED BY EDUCATIONAL SERVICES SECTION

RIVETING
SOLID - SHANK
CONVENTIONAL
RIVETS

GENERAL DYNAMICS
Fort Worth Division

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INTRODUCTION

This manual contains basic information for correctly installing solid-shank rivets - the way it's done by experienced mechanics.

The information included in this manual is subject to change and is for reference only. The official sources of information are Engineering Drawings, Technical Process Instructions (TPIs), Process Memos (PMs), Process Standards (PSs), Standard Practice (SPs) books, and Design Standard M100, which covers installation of solid rivets.

Read this manual carefully to become familiar with the information it contains. Save the manual for future reference.

Your best source of information about your job and your company is your supervisor. Always consult your supervisor when in doubt about procedures on any job.

Always spend a few minutes checking your work after you have completed it. A good mechanic discovers his mistakes and corrects them before he submits his work for inspection.

NEVER COVER UP A MISTAKE!!

GENERAL INFORMATION

The responsibility for producing safe, dependable aircraft of high-quality workmanship belongs to you. Your skill and care in handling all materials, parts and assemblies is essential to a good product. And development of a good riveting technique is a basic skill the aircraft mechanic must acquire.

> Remember our slogan --
> Good Design/Fine Workmanship

Rivets are used extensively throughout aircraft structures and must be installed properly to do their jobs. And the job of every rivet is an important one. (Maybe you remember the old saying that begins "For want of a nail ...").

The mechanic must have a knowledge of rivets, rivet equipment and procedures plus experience to develop the "feel" of riveting.

PRODUCT DISCIPLINE

Material used in aircraft construction makes product discipline an important part of riveting procedures.

Careless handling of rivet equipment may result in scratches, nicks and cracks on the aircraft surfaces. Such damage can affect the strength of highly stressed parts.

> Product discipline is a primary responsibility of each employe of this Division.

You are personally responsible for:

1. Conducting your assigned duties in a business-like manner with an acceptable level of competence

2. Proper use and care of tools, materials, equipment and facilities while on the premises

3. Asking for further instructions from your immediate supervisor when you are uncertain of assigned tasks.

> Quality, in addition to production, is the key word.

FOREIGN OBJECT DAMAGE (FOD)

Stop foreign object damage whenever you can:

NOTE

Foreign Object Damage is damage caused by any object (rivets, bolts, nuts, etc,) which if left in the area of highly integrated and critical operational systems, could possibly cause damage to the airplane or system (engines, flight controls, electrical, linkages, tires, etc).

- Clean as you go.
- Pick up loose materials before you leave the area.
- Don't use the aircraft as a workbench - maintain good housekeeping.
- Account for all your tools. Don't place them where they can slide behind a panel, etc.
- Don't depend on cleanup at the end of the shift to prevent FOD. Maintain areas properly during work - there will be less cleaning at the end of the shift, less chance to overlook FOD.

The description of a rivet is obtained by combining the standards number, the material code letter, the rivet diameter and the rivet length. This is the part-number code that is indicated on the drawing as a symbol. The symbol code is identified in the title block or in drawing general notes.

The following examples explain the significance of rivet part numbers.

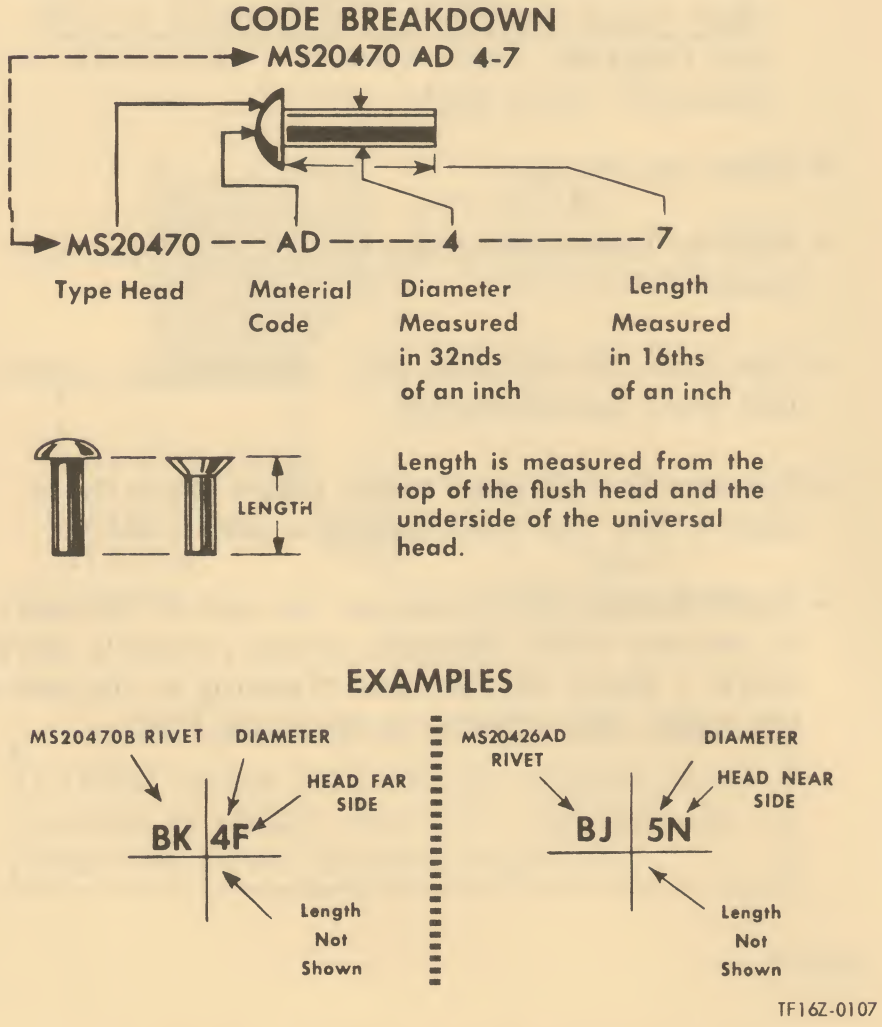

Figure 1. Rivet Identification

Solid-shank rivets are manufactured from several kinds of metal to fulfill specific requirements. These metals are identified by a material code letter and a system of markings on the rivet head. This is shown in the table below.

HEAD MARKING	RIVET ALLOY	COLOR	MATERIAL CODE	HEAT TREAT BEFORE USING
PLAIN	2219-T81	VIOLET	NONE	YES
RAISED CROSS	5056-F (56S)	ALODINE FILM	B	NO
RECESSED DOT	2117-T3 (A17ST)	GREENISH-YELLOW	AD	YES
RAISED DOT	2017-T3 (17ST)	RED	D	YES
RAISED DOT	2017-T31 (17SW)	LIGHT BLUE	D	YES
RECESSED DASH	CRESc		F	NO
RECESSED TRIANGLE	STEEL		C	NO
PLAIN	MONEL		M	NO
PLAIN	CRESc		F	NO
PLAIN	COPPER		C	NO
PLAIN	MONEL CAD. PLATED	CAD. PLATED	M-C	NO
2 RAISED DASHES	2024-T31 (24SW)	GREEN	DD *	YES
2 RAISED OR RECESSED DOTS	MONEL		M	NO

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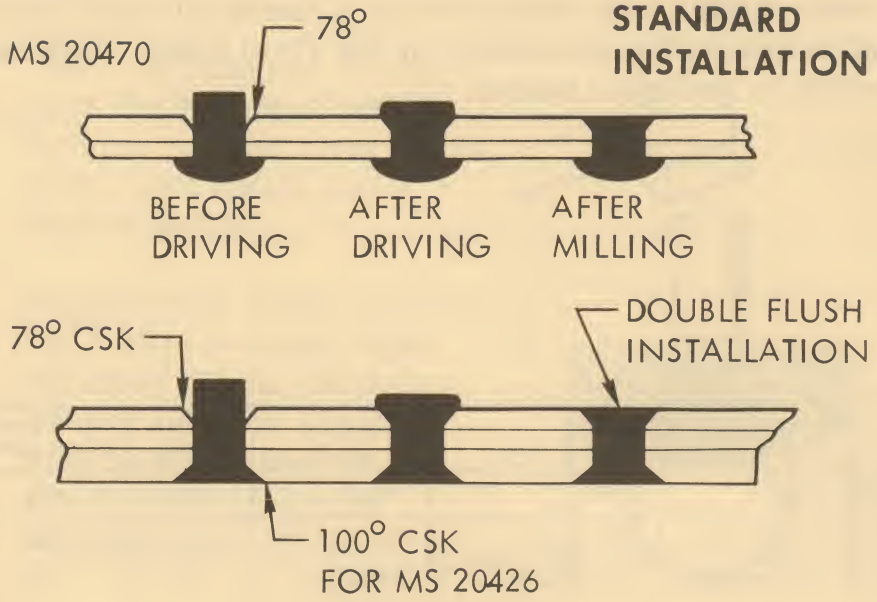
Figure 2. Rivet Material Code



MS 20470 universal head or the MS 20426 flush rivet is used as required.

The procedure for forming the upset head used in a double flush installation is the same as for standard riveting except the head is formed in a countersunk hole, and it must be completely filled. The formed head is then milled flush with a micro-shaver.

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Figure 3. Rivet Installation

The length of a solid-shank rivet is not designated on drawings. The mechanic must select the proper length to form a head that will be the right size after it is installed.

Allowance is made for the rivet shank to expand in the hole during forming. As a rule the shank should protrude through the material at least 1.0 to 1.5 times the diameter of the shank.

GRIP RANGES FOR RIVET LENGTHS AND DIAMETERS

RIVET LENGTH L		1/8 DIA		5/32 DIA		3/16 DIA		1/4 DIA		5/16 DIA		3/8 DIA	
		GRIP T		GRIP T		GRIP T		GRIP T		GRIP T		GRIP T	
Fraction	Dash No.	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
5/32	-2.5	.015	.057										
3/16	-3	.058	.094	.020	.071								
1/4	-4	.095	.130	.072	.124	.064	.120						
5/16	-5	.131	.178	.125	.187	.121	.175	.091	.103				
3/8	-6	.179	.230	.188	.249	.176	.219	.104	.175				
7/16	-7	.231	.295	.250	.314	.220	.276	.176	.216				
1/2	-8	.296	.350	.315	.375	.277	.335	.217	.265	.242	.298		
9/16	-9	.351	.410	.376	.428	.336	.394	.266	.339	.299	.355		
5/8	-10	.411	.468	.429	.481	.395	.453	.340	.385	.356	.410	.188	.250
11/16	-11	.469	.525	.482	.530	.454	.513	.386	.445	.411	.467	.251	.313
3/4	-12	.526	.597	.531	.587	.514	.569	.446	.491	.468	.524	.314	.375
13/16	-13	.598	.648	.588	.638	.570	.625	.492	.548	.525	.581	.376	.437
7/8	-14	.649	.715	.639	.702	.626	.680	.549	.602	.582	.630	.438	.500
15/16	-15	.716	.772	.703	.758	.681	.736	.603	.675	.631	.687	.501	.563
1	-16	.773	.840	.759	.810	.737	.791	.676	.728	.688	.744	.564	.625

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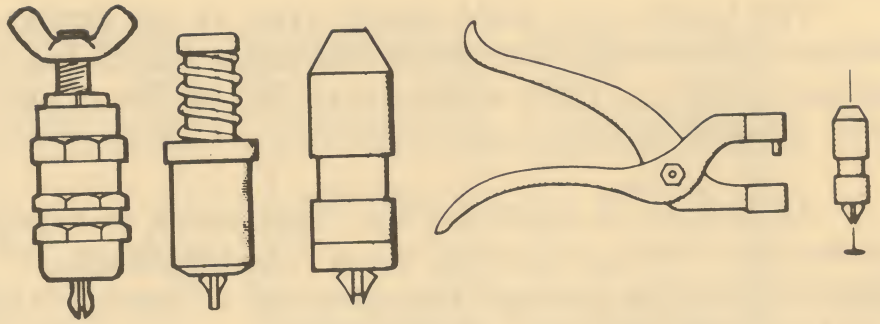
Figure 4. Rivet Length



A Cleco is a spring-loaded clamp used to hold parts together.

Use special pliers to insert Clecos into holes.

Cleco sizes are identified by colors:

SIZE	3/32	1/8	5/32	3/16
COLOR	Silver	Copper	Black	Brass

SAFETY FIRST

Keep Clecos off the floor. Like banana peelings, they are dangerous. Wear safety glasses when using Clecos.

Gaps at joints must be open and within drawing tolerance. A tight joint will cause the material to bind and buckle when riveted.

Before riveting, install all fillers and shims that are required to prevent mismatch and out-of-contour conditions. Removing rivets to correct unacceptable conditions often contributes to loss of time, wasted effort and poor-quality installations.

For safety, conservation, housekeeping - keep Clecos off the floor.

Figure 5. Use of Clecos

Holes for rivets must be the right size, round, clean and free of burrs. Hole-preparation data is found in engineering drawings, operation planning cards and process standards. You can also see the training manual on Proper Hole Preparation in Aircraft Manufacturing which is available as a guide.

Do not force a rivet into a hole that is too small or into holes that are misaligned. This will usually cause a burr to form under the head.

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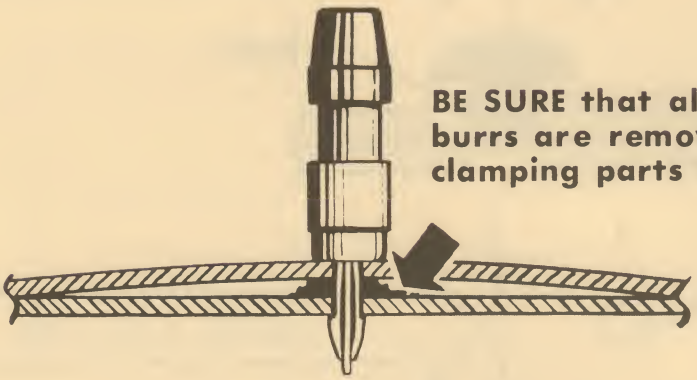
Figure 6. Hole Preparation

1. Deburr all holes.

2. Remove chips from between sheets.

3. Reassemble parts and clamp together - use Clecos or setup bolts.

4. Check for excessive gaps, mismatch, bends, etc.



5. Check for hole alignment. Holes must align so that there is no need for redrilling or forcing rivets into holes.

Do not use Clecos for hole alignment - Clecos are used only to hold parts together.

6. Before using Clecos, improve hole alignment by first installing screws or bolts. If it is an all-riveted assembly, insert a few rivets (do not shoot) into the holes.

7. Install the Clecos.

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Figure 7. Preparation for Riveting

Solid-shank rivets are installed by upsetting the shank with a rivet gun and bucking bar, or with a rivet squeezer. Selection of either method is most often determined by the size and accessibility of the assembly.

The squeezer method is the most economical and produces high-quality, uniform rivets.

The aircraft mechanic must be skilled in both methods.

The following table gives the type and capacity of rivet guns and squeezers.

RIVET GUN SIZE

	RIVET GUN	RIVET DIAMETER
Vibrator Type	CP2X, CP0Y, AVC-10, E2	1/16, 3/32, 1/8
	AVC-11, E3, CP459	1/8, 5/32
	AVC-12, AVC-13, E4	5/32, 3/16
	AVC-13, AVC-26	3/16, 1/4
	5X, 9X	1/4, 5/16
	9X, 10X	5/16, 3/8
	AVC-36	1/2

RIVET SQUEEZERS

PORTABLE TYPE	RIVET DIAMETER SIZE
CP214, PRS10	1/16, 3/32, 1/8
CP351, CP355	1/8, 5/32, 3/16, 1/4
STATIONARY TYPE	
625 and CP450EA	3/32, 1/8, 5/32, 3/16, 1/4

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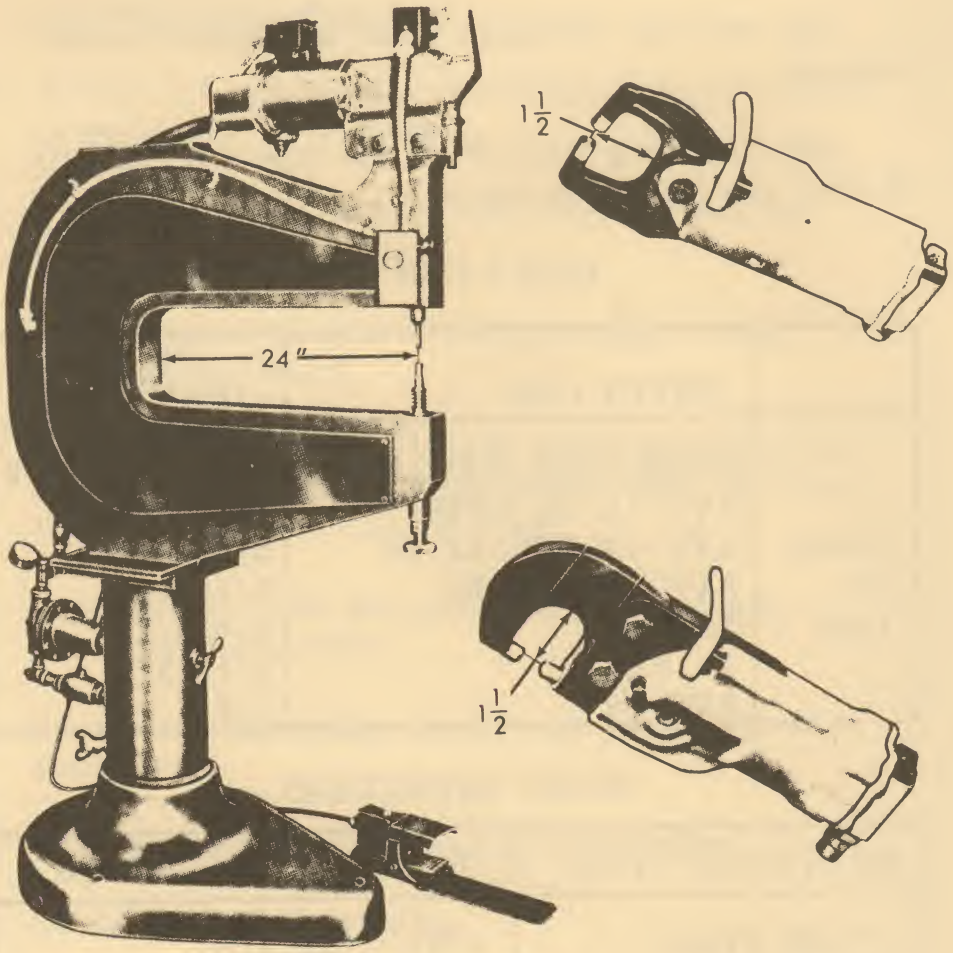
Figure 8. Selecting Riveting Method

Solid-shank rivets may be driven by using a portable or stationary squeezer.

Both portable and stationary models are operated by air. To prevent accidental engagement, always disconnect the air supply when changing sets or when the squeezer is not in use.

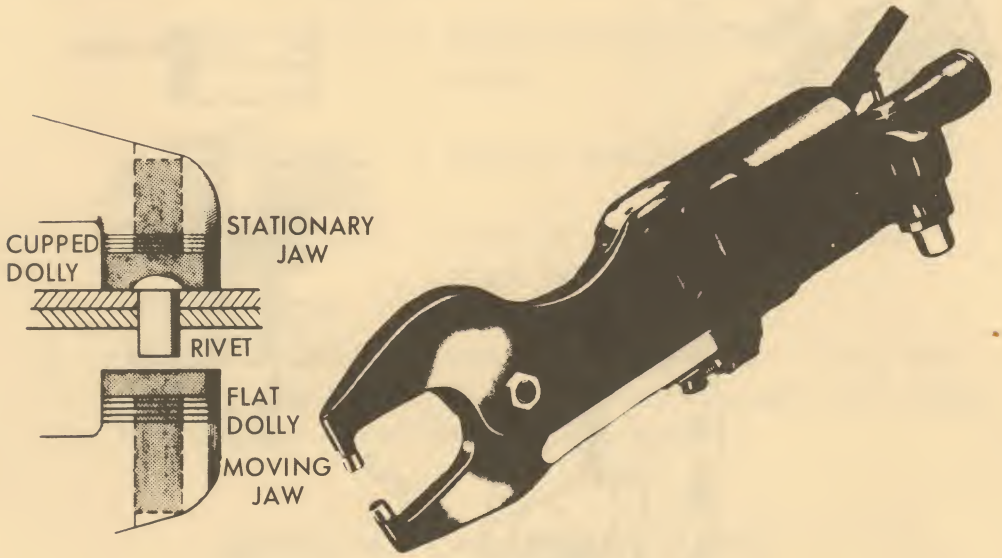


A pressure-relief valve on the cylinder or adjustable sets is used for regulating the height of rivet heads.

TF16Z-0115

Figure 9. Rivet Squeezers (Sheet 1)

The Type C and alligator jaw head yokes are most commonly used. Many squeezers, with either head yoke, are already set up for rivets of certain lengths and for specific jobs. Since adjustment is for a rivet of a specific length, any readjustment should be made by the tool service department.



A squeezer is operated by depressing the valve lever, causing a plunger to move the yoke jaws together and upset the rivet.

The force is obtained by a piston-cam arrangement that provides a fast initial start and a slow final travel.

Start out with low pressure regulator adjustment, and increase pressure until the head is properly formed.

If full pressure is applied without initial low pressure, both the rivet and material may be crushed.

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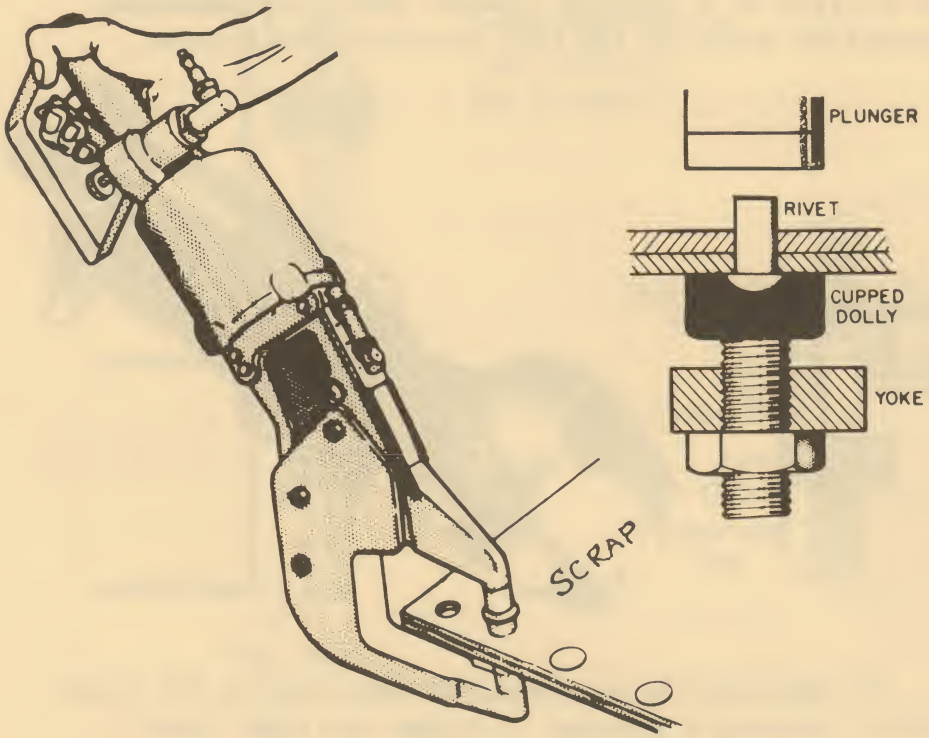
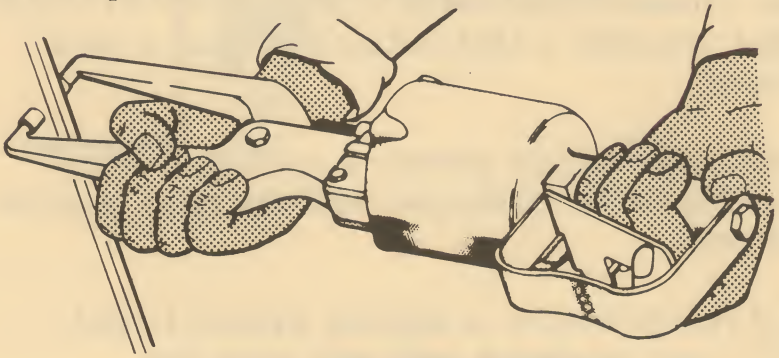
Figure 9. Rivet Squeezers (Sheet 2)

The large stationary squeezer and some of the portable squeezers have adjustable sets. When making adjustments, use scrap material of the same thickness as that being riveted.



Do not use any squeezer unless you are familiar with its operation - ask your foreman.



SAFETY FIRST

Keep hands and fingers out of the jaws.

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Figure 9. Rivet Squeezers (Sheet 3)

The CP-805 pneudraulic pump operates the pneudraulic riveter CP-507 with a "C" yoke P-16740Y. The riveter package in this configuration is used on F-16 wing section to drive 3/8" steel rivets; however, it can be adapted for many other applications.

The pneudraulic pump operates off 90 psi shop airlines. The pump delivers a closely regulated supply of oil pressure up to 10,000 psi. The pumping action is controlled by depressing the trigger on the riveter. When the trigger is released, pressure from the pump to the riveter is released. If the trigger is held down, pressure will release when set pressure is released. The output pressure can be adjusted by means of a convenient dial on top of the unit.

> Operating pressure must be set and tested prior to performing riveting operation.

The riveting procedure for this riveter is much the same as that for the small conventional riveters.

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Figure 9. Rivet Squeezers (Sheet 4)

Some rules to remember when riveting with this unit are as follows:

1. Place the riveter on the rivet head and hold the riveter perpendicular to the structure being riveted.

2. Hold the riveter and yoke firmly with both hands.

3. The mechanic's feet must be placed firmly and body well balanced. (The unit weighs approximately 33 pounds.)

4. Squeeze and hold the trigger depressed until the riveting action is completed.

5. Be sure the rivet set is the right size for the rivet head.

6. Return all burnished or damaged rivet sets to tool service department for repair or replacement.

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Figure 9. Rivet Squeezers (Sheet 5)

The vibrator or fast-hitting type gun gives a series of strokes as long as the trigger is depressed. Choose the proper rivet gun for the job.

	RIVET GUN	RIVET DIAMETER
Vibrator Type	CP2X, CP0Y, AVC-10, E2	1/16, 3/32, 1/8
	AVC-11, E3, CP459	1/8, 5/32
	AVC-12, AVC-13, E4	5/32, 3/16
	AVC-13, AVC-26	3/16, 1/4
	5X, 9X	1/4, 5/16
	9X, 10X	5/16, 3/8
	AVC-36	1/2

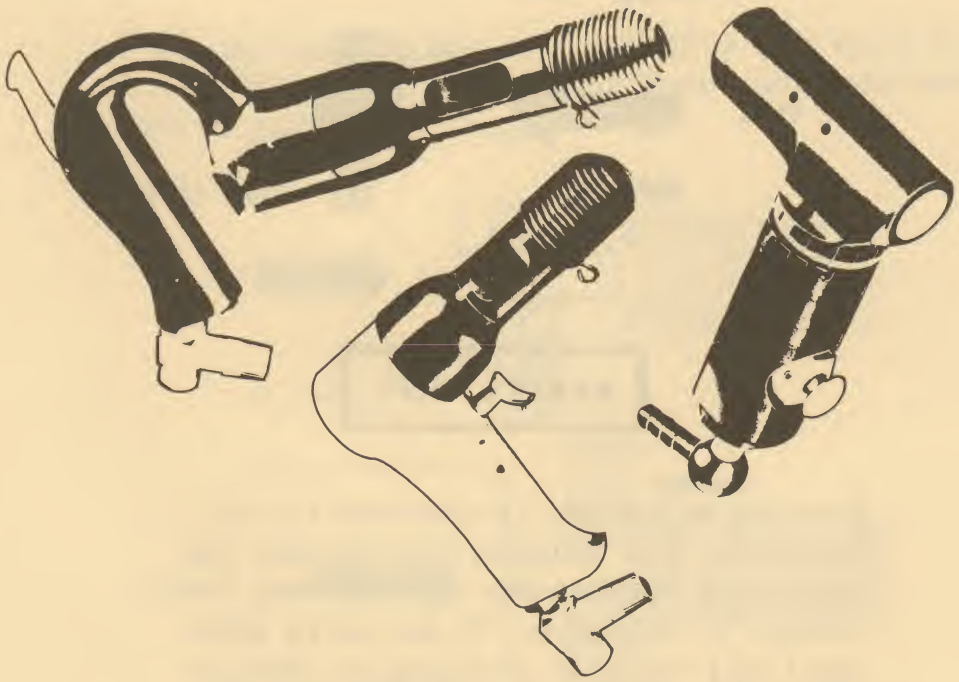

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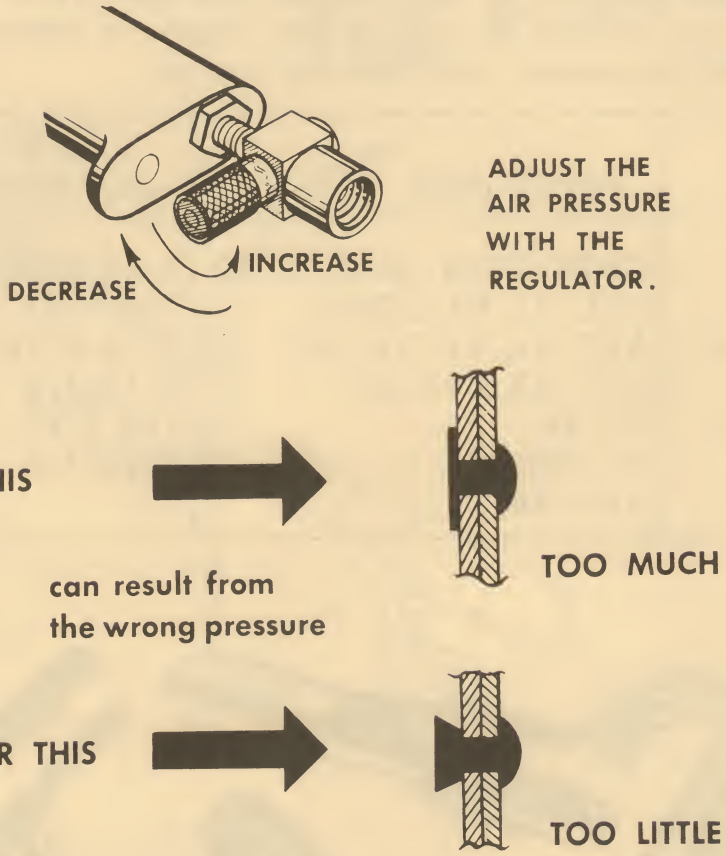
Figure 10. Rivet Gun

The rivet gun is operated by compressed air.



SAFETY FIRST

Riveting equipment is operated by air pressure. The equipment is simple, but dangerous if rules are not followed. Don't indulge in horseplay. To be sorry afterward will not undo an injury or damage resulting from practical jokes.

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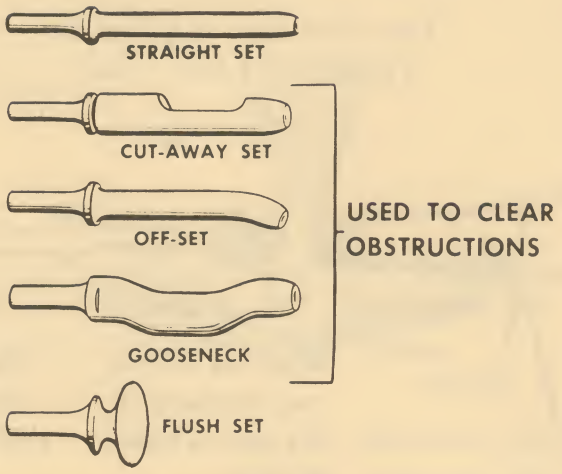
Figure 11. Rivet Gun Adjustment



Rivet sets are steel shafts that are inserted into the end of the gun to transfer the vibrating power from the gun to the rivet head.

The set must fit the head of the rivet and be perpendicular to the rivet head during installation. Hold the rivet set and gun firmly to prevent "walking" on the skin surface.

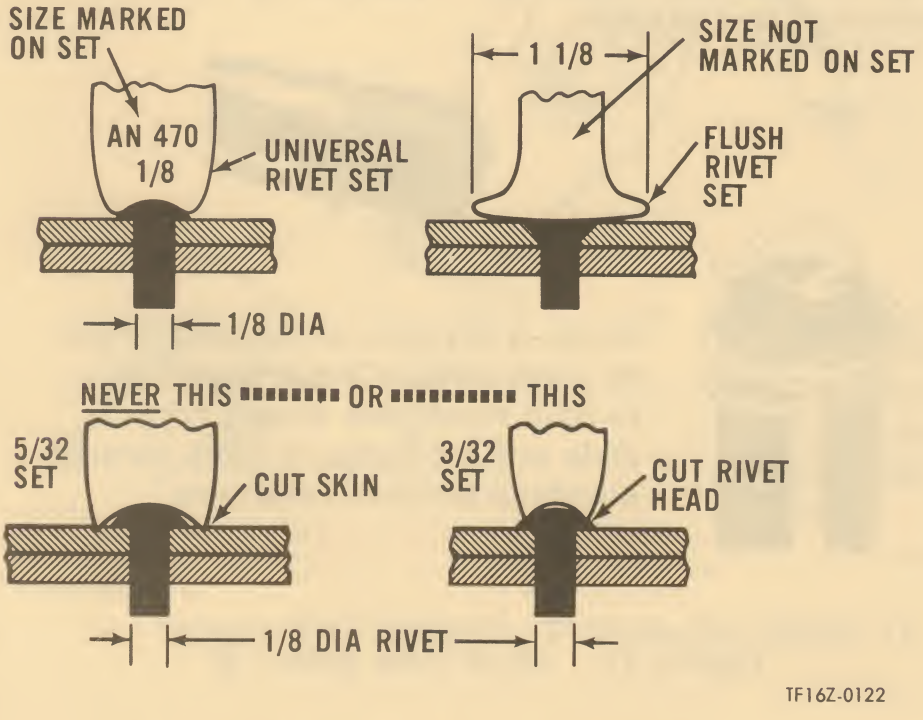
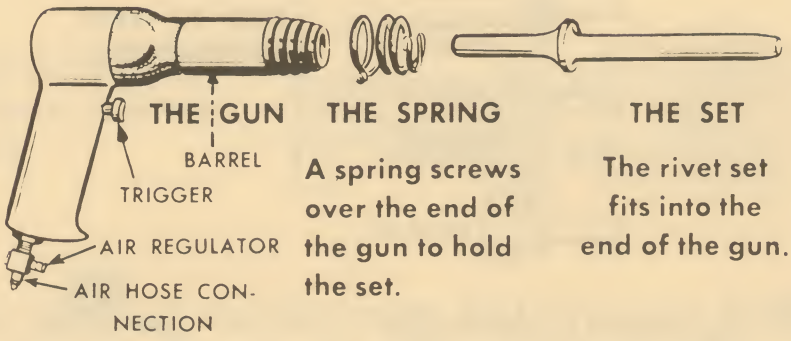


Figure 12. Rivet Sets (Sheet 1)

ASSEMBLY:

The Gun and the Set Go Together Like This:



RETAINER SPRINGS:

A retainer spring is used to hold the rivet set in the gun. This keeps the set from leaving the gun when it is accidentally triggered - preventing injury to personnel and product.

Mech-Aid rivet-set retainers can be used on all CP aerohammers to hold rivet sets whose cupped ends are too large to pass through standard beehive retainers.

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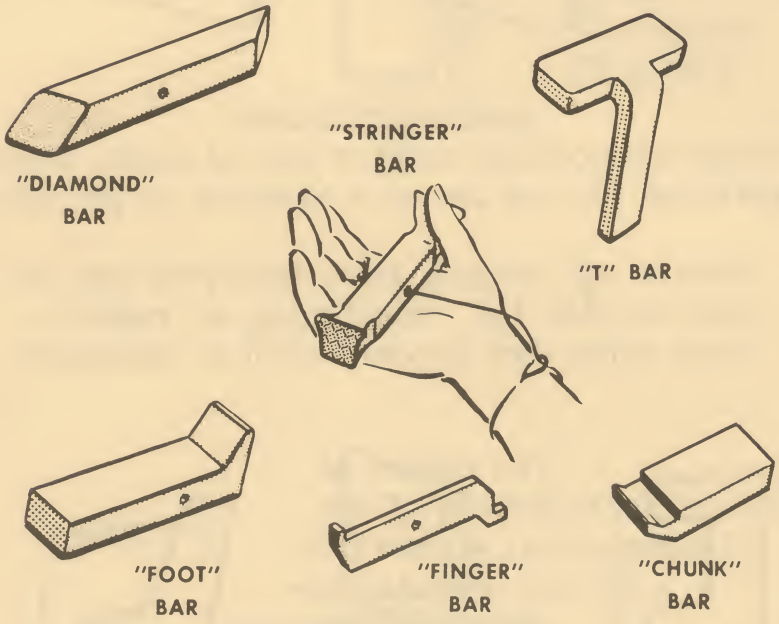
Figure 12. Rivet Sets (Sheet 2)

Bucking bars are not just pieces of steel. They are expensive and necessary tools. They are designed in a variety of shapes and sizes to upset the driven head of a rivet. Treat them as precision tools.



Bucking bars are made in different shapes and sizes to fit particular riveting situations.

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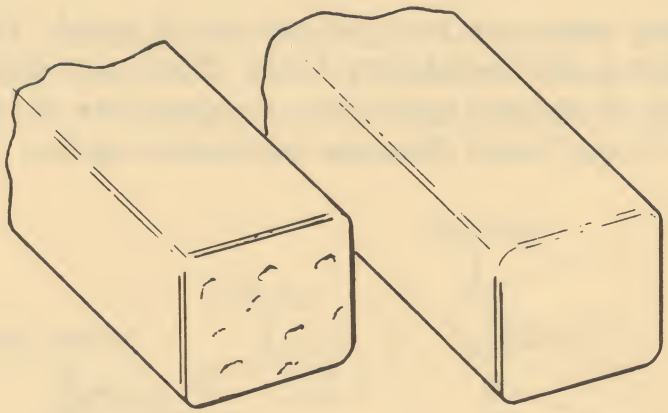
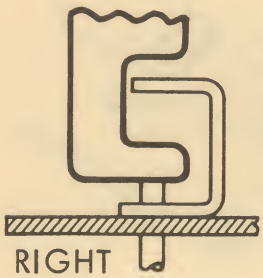
Figure 13. Bucking Bars (Sheet 1)



Keep the working surface free of nicks, smooth and polished. Do not use as a hammer or pry bar.

Return all bucking bars and rivet sets to tool service for resurfacing or replacement when they become worn or damaged.



The center of gravity of the bar should fall as near as possible over the rivet shank.

A bar that is too light will not support the material being riveted. The material will defect, causing the rivet set to bounce and mark the surface, or make a hole or crack in the material.

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Figure 13. Bucking Bars (Sheet 2)

Keep the bar from making contact with radius of angles or other parts. Be sure the bar has rounded edges and the face is polished and free of nicks.

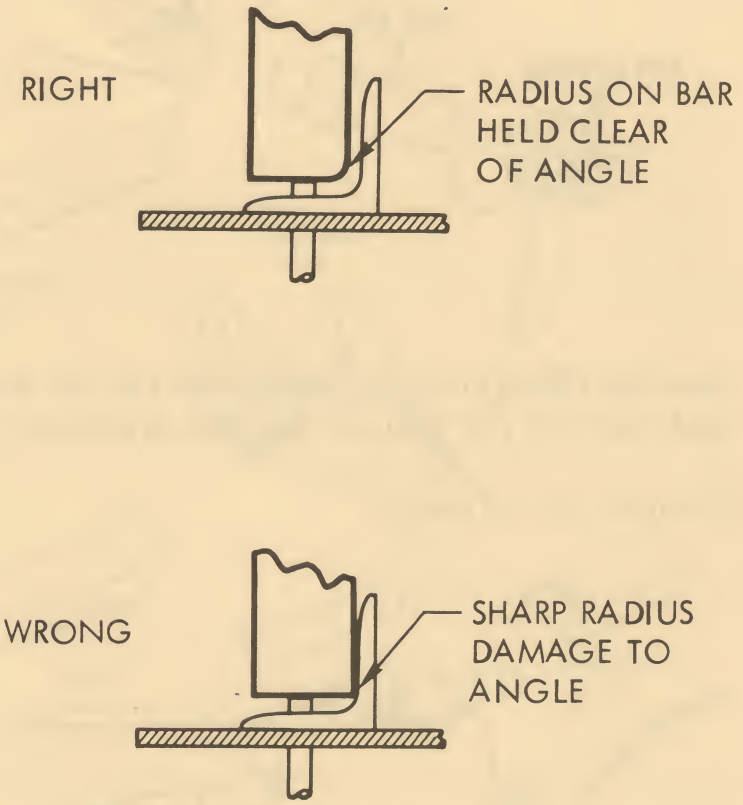
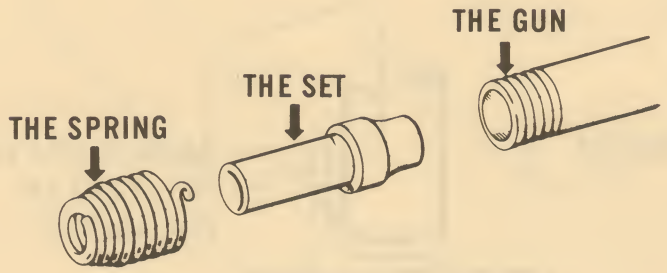


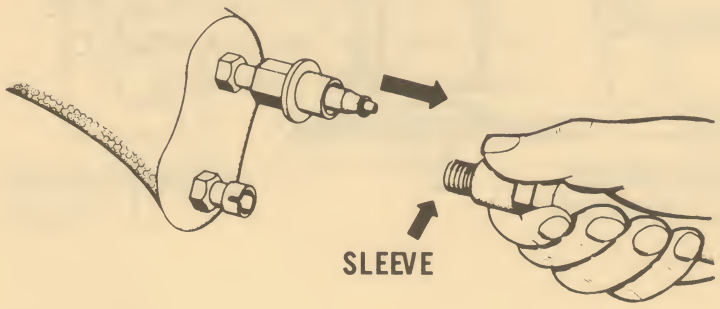
Figure 13. Bucking Bars (Sheet 3)

1. Install proper set in the gun. Use safety retaining spring to hold the set in (some flush sets have no provisions for springs). Remove spring from the gun when not actually riveting.



Use the right size and shape set for the job. Call tool service for help on special problems.

2. Connect air to gun.



Connect the airhose by pulling back the sleeve of the connector and pushing the end of the union on the gun.

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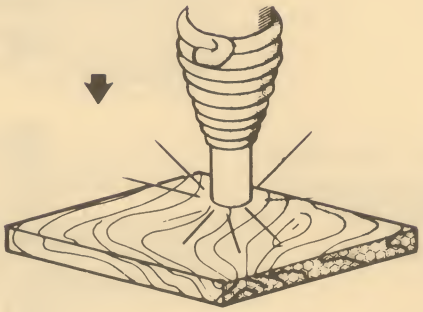
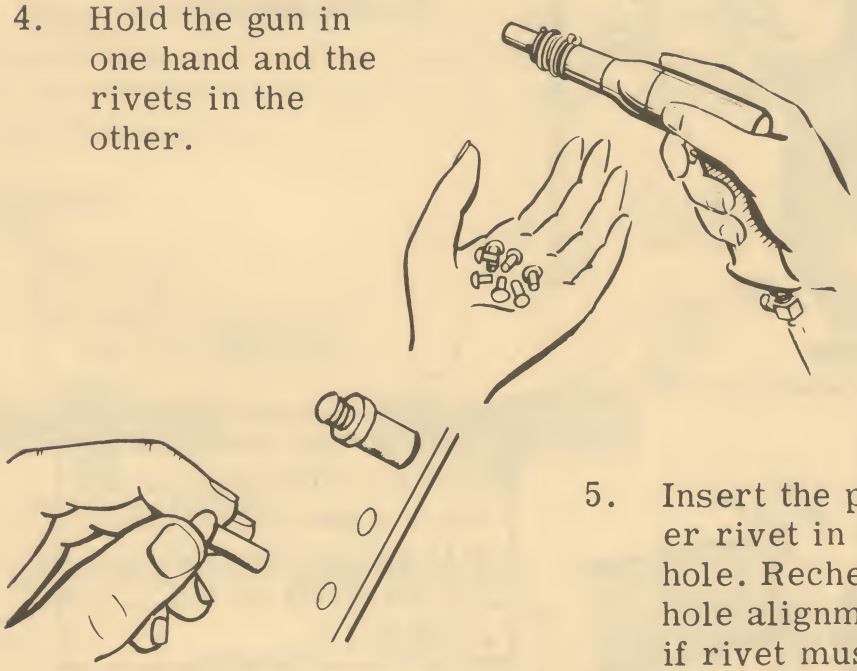
Figure 14. Riveting Procedures (Sheet 1)

3. Adjust air.



Hold set against block of wood while pulling trigger. Adjust regulator.

4. Hold the gun in one hand and the rivets in the other.



5. Insert the proper rivet in the hole. Recheck hole alignment if rivet must be forced.

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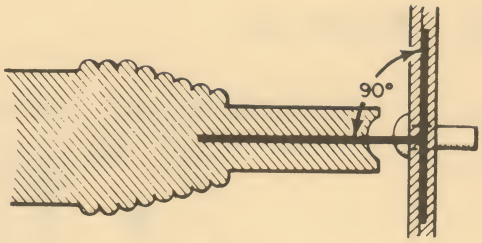
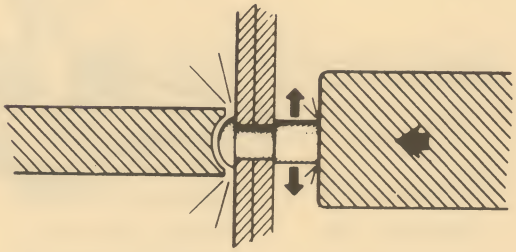
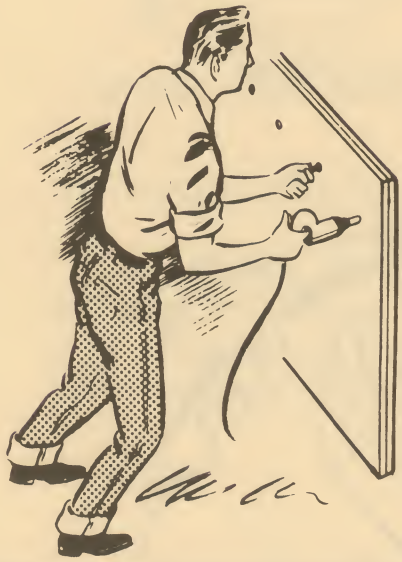
Figure 14. Riveting Procedures (Sheet 2)

6. Place set against the rivet.

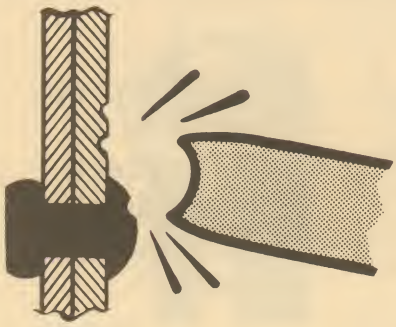


7. Hold bucking bar against shank of rivet.





8. Stand behind the gun. Keep elbow in front. Lean forward with weight against gun.



Body weight must be applied while squeezing the trigger or the gun will bounce off, cutting the material or the rivet head.

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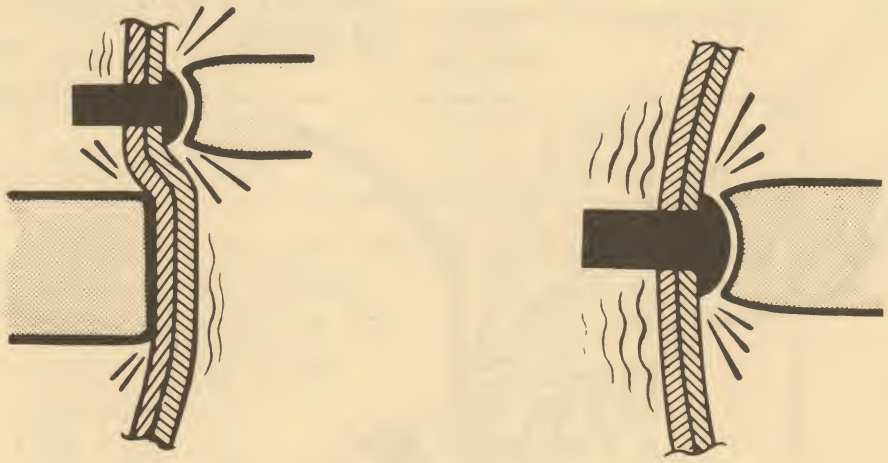
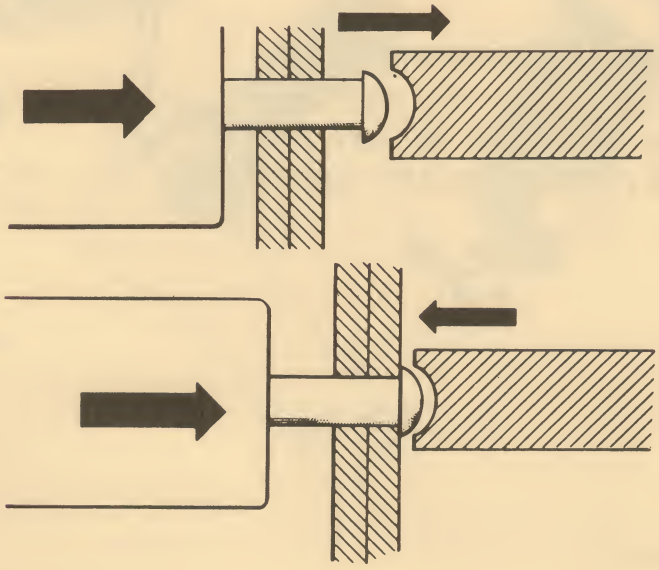
Figure 14. Riveting Procedures (Sheet 3)

Before squeezing the trigger . . .



be sure the bucker is ready and the bucking bar is on the rivet.

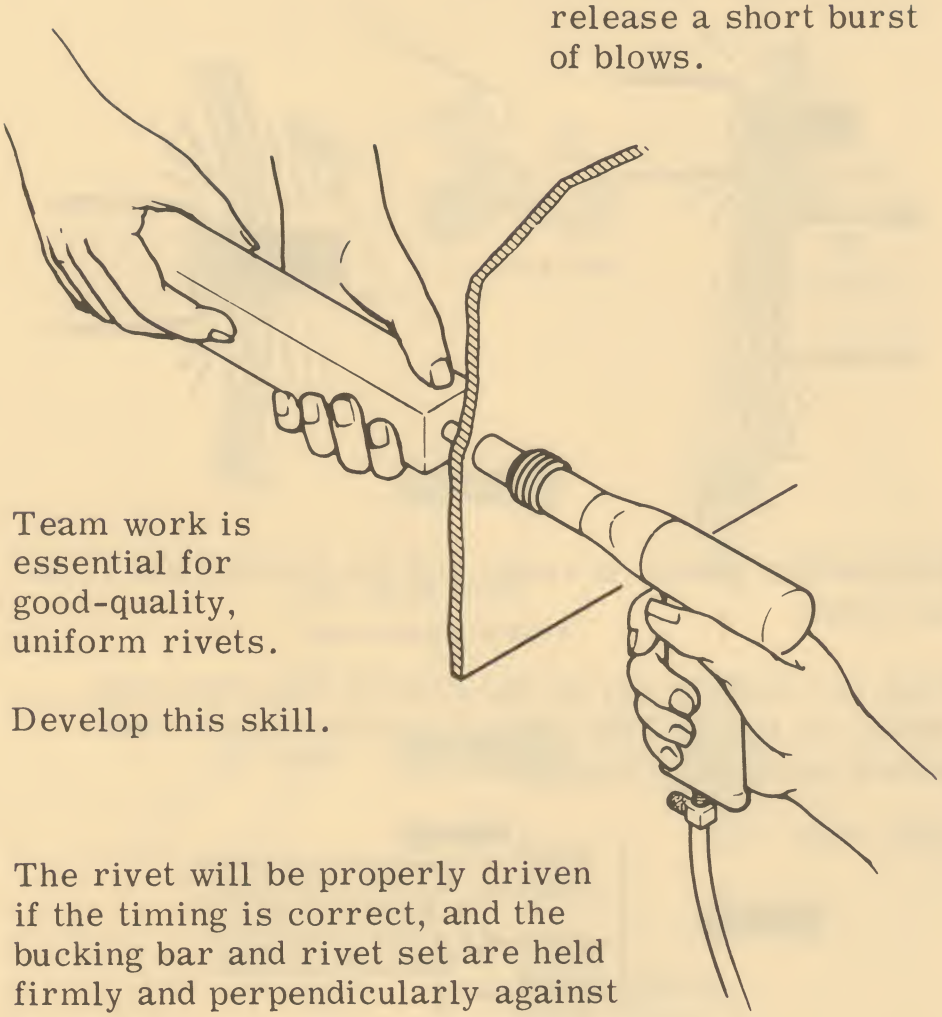
Push the bucking bar so the riveter will know the bucker is ready. The riveter then must push back before pulling the trigger.



TF16Z-0130

Figure 14. Riveting Procedures (Sheet 4)

9. Pull the trigger to release a short burst of blows.



Team work is essential for good-quality, uniform rivets.

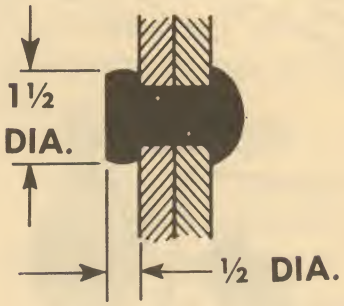
Develop this skill.

The rivet will be properly driven if the timing is correct, and the bucking bar and rivet set are held firmly and perpendicularly against the work.

TF16Z-0131

Figure 14. Riveting Procedures (Sheet 5)

The flattened part of the shank is called the upset head.

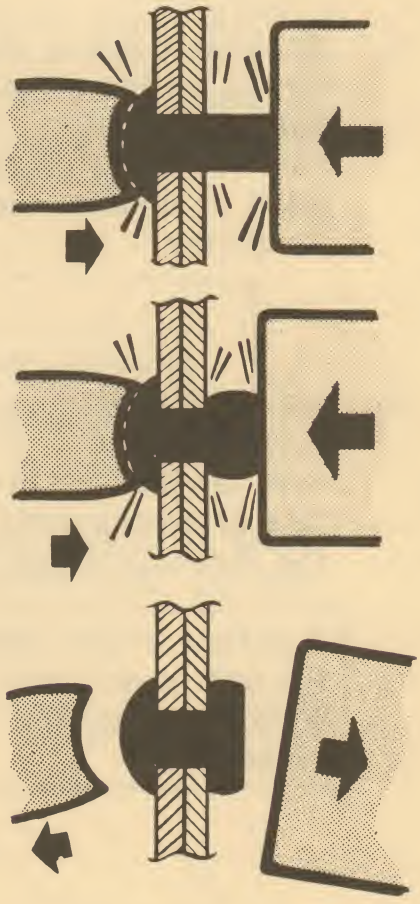


The upset head diameter should be 1.2 to 1.5 times the shank diameter, the height 1/2 times the shank diameter.

1. The rivet is driven against a flat piece of steel called a bucking bar.

2. The gun vibrates and transmits vibration through the material and the rivet to the bucking bar, which is held against the rivet.

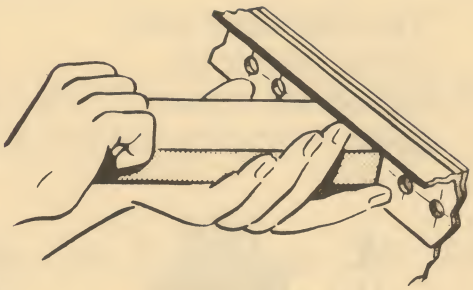
3. Learning to buck rivets is as important as learning to shoot rivets. Riveting is done by teams, with each partner taking his turn at shooting and bucking.



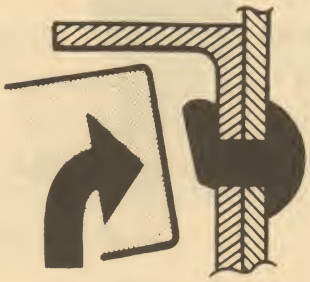
TF16Z-0132

Figure 15. Forming the Upset Head

1. When bucking rivets, hold the bar firmly. Place fingers against the structure to help control the bar.

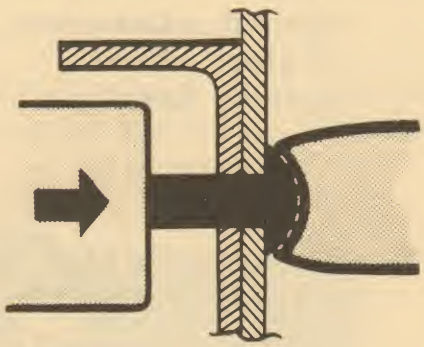


2. The bucking bar must also be held at a 90-degree angle to the rivet or this will happen . . .

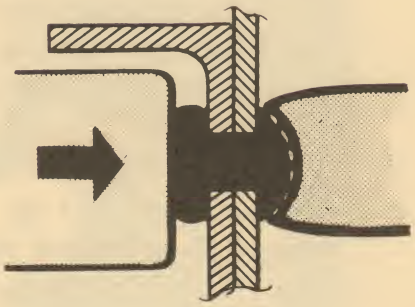


"CLINCHER"

3. Hold the bucking bar firmly on the rivet. Support the bar so it cannot bounce off the rivet or against the structure.



4. As riveting begins, increase pressure with the bar. Maintain pressure until the riveting stops.



A hollow sound means the bar is not held firmly against the rivet.

TF16Z-0133

Figure 16. Bucking the Rivet

1. Communication between the rivet bucker and the rivet driver is often difficult due to noise and enclosed structure. A universal tapping code has been established to enable team members to "talk" to one another:

   One tap - start or resume driving rivet.

   Two taps - rivet is satisfactory.

   Three taps - rivet is unsatisfactory and must be removed.

2. The rivet bucker uses the bucking bar to tap the code on the rivet. The rivet driver feels the code through the rivet set and the gun.

NEVER TAP ON SKIN OR PARTS

3. When the gun stops, the bucker signals.

4. He must not start it again until he has had a signal from the bucker.

   It might cause this - spoiling the material.

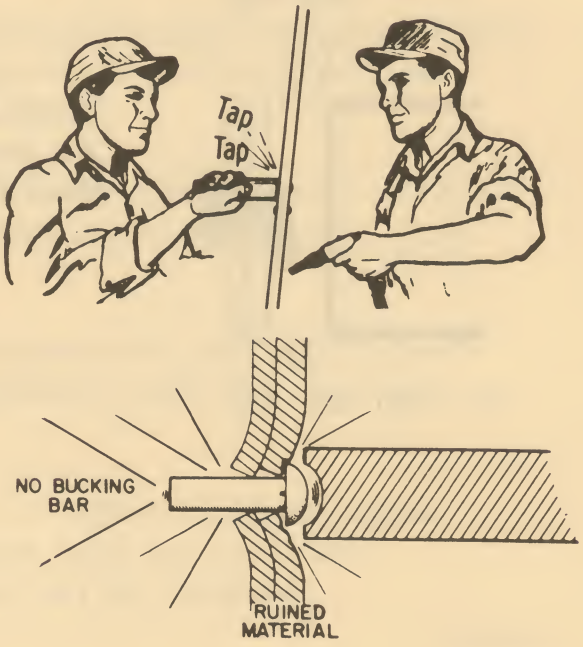
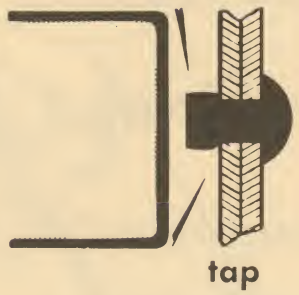
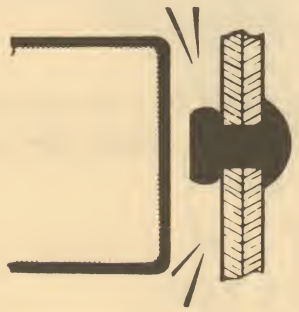


Figure 17. Bucking Signals (Sheet 1)

Signals are used to coordinate the riveting team.



One tap means "not enough, hit it again."



Two taps mean "OK."

Three taps mean "no good — mark for removal."

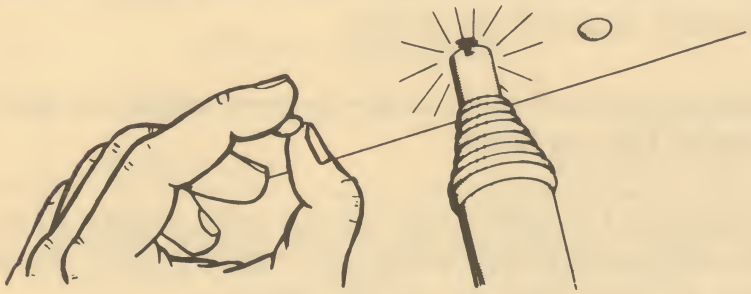
TF16Z-0135

Figure 17. Bucking Signals (Sheet 2)

1. When testing the pressure, always hold the set against a piece of wood. Through practice you will learn the correct air pressure to use.

2. Practice riveting, and you will get the feel. This "feel" is called timing. It is the time needed to drive a rivet of a particular size.

3. As you develop your skill and timing, you will become an experienced riveter. An experienced riveter puts a rivet in the next hole while driving the last.



4. It is the responsibility of the aircraft mechanic to use his skill and knowledge to work to the correct change configuration.

5. Develop a sequence of riveting when working on contoured surfaces to prevent buckling or "cans." Install rivets so that any slack is worked toward the outer joints.

TF16Z-0136

Figure 18. Riveting Tips (Sheet 1)

6. Use a slow-action gun; it's easier to control.

7. Use a gooseneck gun for exterior surfaces.

8. Use an offset gun for interior riveting.

9. Use 1-1/8 inch bell-type rivet set for general-purpose flush riveting.

10. Adjust air pressure sufficiently to drive a rivet in two or three seconds.

11. Use body weight to hold the rivet gun and set firmly against the rivet.

12. Hold gun barrel at a 90-degree angle to the material surfaces.

13. Squeeze trigger by gripping with entire hand as though squeezing a sponge rubber ball. Be sure the bucking bar is on the rivet.

14. Operate the rivet gun with one hand; handle rivets with the other.

15. Spot-rivet assembly; avoid reaming holes for spot rivets.

16. Plan a sequence for riveting assemblies.

17. Drive rivets to a rhythm.

TF16Z-0137

Figure 18. Riveting Tips (Sheet 2)

1. A good mechanic should strive to make all rivets perfect. The bucked heads should be uniform and within engineering specifications to pass quality inspection.
2. The mechanic should recognize and correct the causes of bad rivets. Don't leave bad rivets for the inspector to find - you are as good an inspector as he is, and you have the tools and the know-how to make it right. Corrections will eliminate costly writeups and prevent poor workmanship reports.
3. Manufactured heads should be smooth, free of tool marks and have no gaps under the head after riveting.
4. There should be no cracks in the material.
5. The head must not be cracked or cocked.
6. The upset head should be uniform and within 1.2 to 1.5 times the width of the rivet diameter.
7. The upset head should be 0.5 times as high as the rivet diameter.
8. When a rivet is to be removed, use the following chart to select proper size drills for the job.

RIVET DIAMETER	DRILL SIZE TO REMOVE HEAD	DRILL SIZE FOR SHANK
3/32	#43	#50
1/8	#32	#40
5/32	#26	#30
3/16	#16	#20
1/4	C	#10
5/16	N	F
3/8	U	5/16

TF16Z-0138

Figure 19. Rivet Inspection (Sheet 1)

Inspection Marks

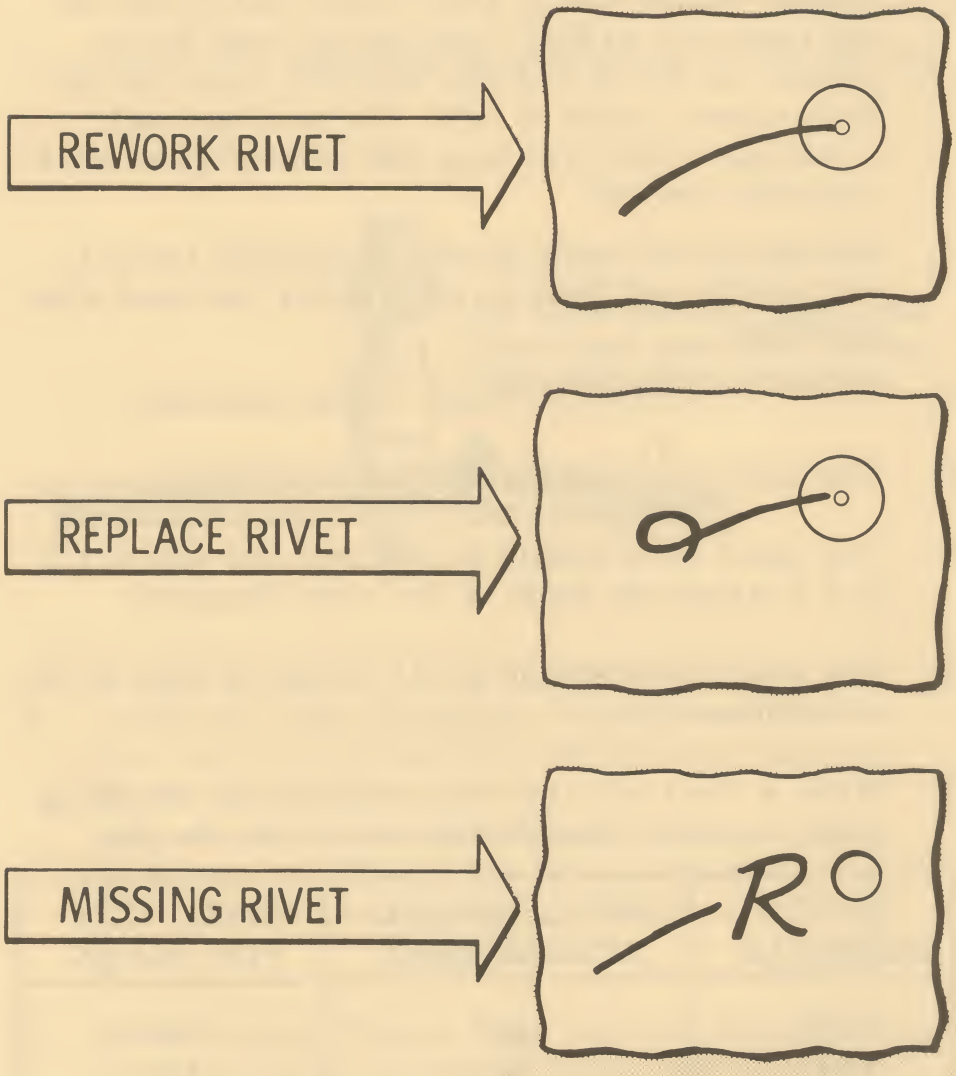


Figure 19. Rivet Inspection (Sheet 2)

Causes for Rejection

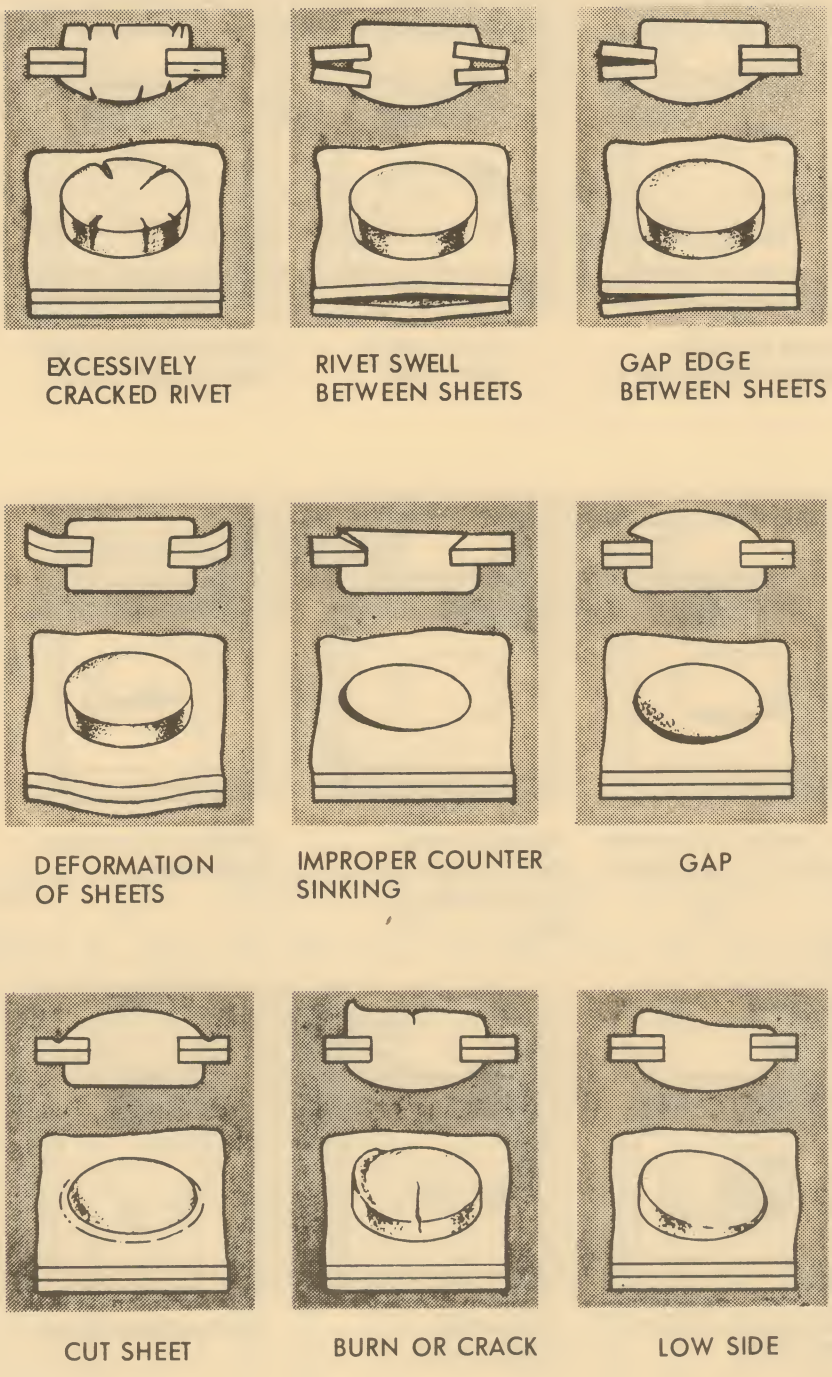


Figure 19. Rivet Inspection (Sheet 3)

Causes for Rejection

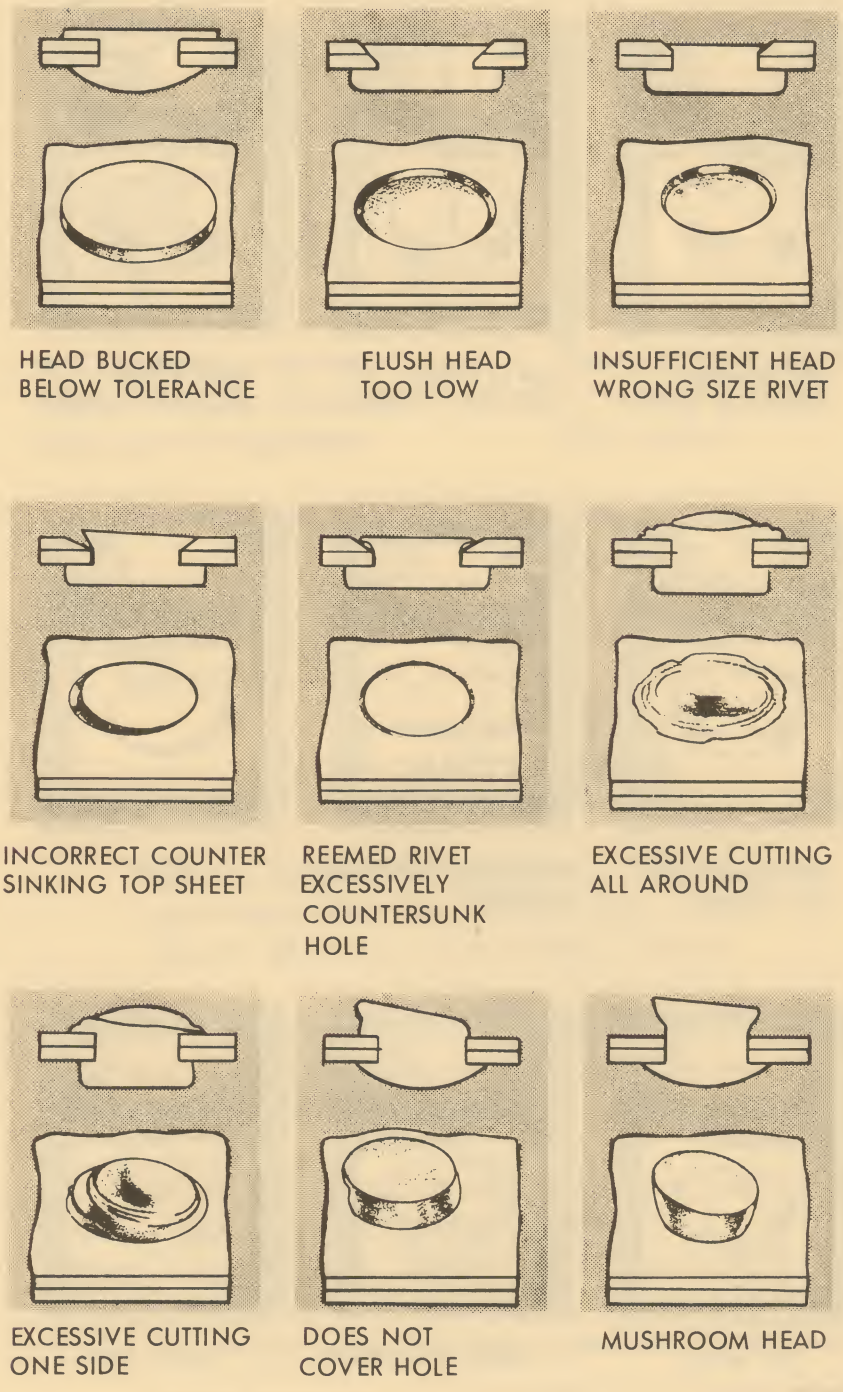


Figure 19. Rivet Inspection (Sheet 4)

Rivets that do not meet acceptable quality standards must be replaced. The replaced rivets are much more difficult to install than were the original ones. This is due to the swelling action that causes slight enlargement of the hole.

Rivet removal is most important in the replacement process.

1. Center-punch "A" and "DD" rivets. "AD" rivets need no center-punching since they are dimpled.

2. Select the correct size drill and pin punch. Use same size drill as used to make original hole.

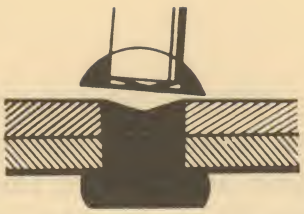
3. Start the drill at the center of the head. Drill in a straight line with the rivet shank.

4. Drill to a depth where the head of the rivet joins the rivet shank.

TF16Z-0142

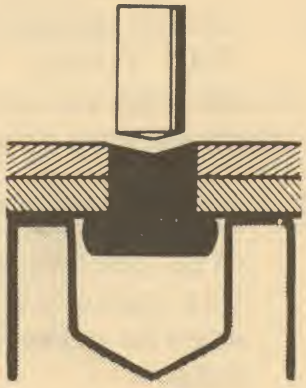
Figure 20. Rivet Removal (Sheet 1)

5. Insert a pin punch into hole in the head of rivet, and pry off rivet head. Pin punch must be the same size as the drilled hole.



6. Use a backup bar to support the material while driving out the rivet shank with a pin punch and a light hammer.

7. Should rivet shank remain tight after several light hammer blows, drill deeper into the shank. Stay in the center of the rivet to prevent hole enlargement.



8. Never use a chisel or a screwdriver to remove a rivet - you cannot keep from cutting the material.

NOTE: When removing flush rivets from dimpled sheets, drill as shown.

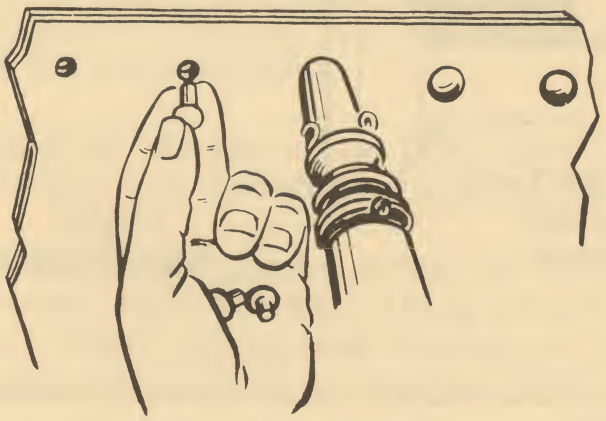
TF16Z-0143

Figure 20. Rivet Removal (Sheet 2)

Reinstalling a rivet requires caution and the best rivet technique. The hole is usually enlarged slightly in the removal process. If that is the case, use rivets one-half size longer.

If the hole is enlarged beyond tolerance, see your foreman for instructions.

The part may have to be scrapped or repaired, or a rivet with a larger diameter may have to be installed. The type of engineering action will depend upon size, type and location of the hole and structure stress and critical areas of installation.



TF16Z-0144

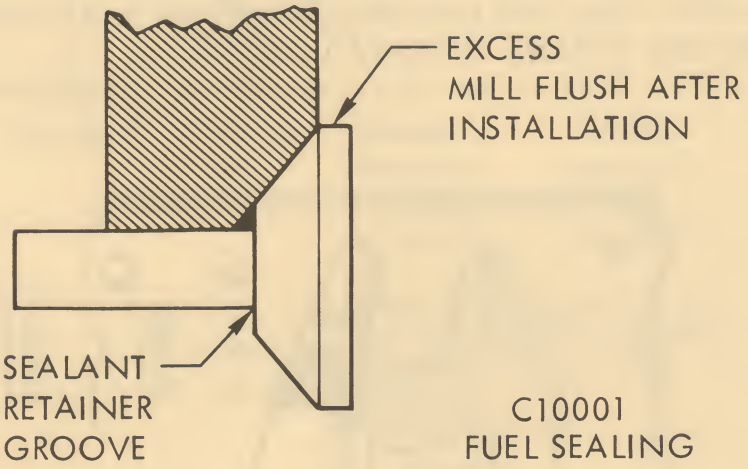
Figure 21. Rivet Replacement

Two special features of the C10001 rivet are:

1. A recess at the intersection of the head and shank for retaining sealant material

2. Extra material on the countersunk head to keep the set from damaging the sandwich-constructed-type panels and skins.

Be sure the countersunk holes are to specification.



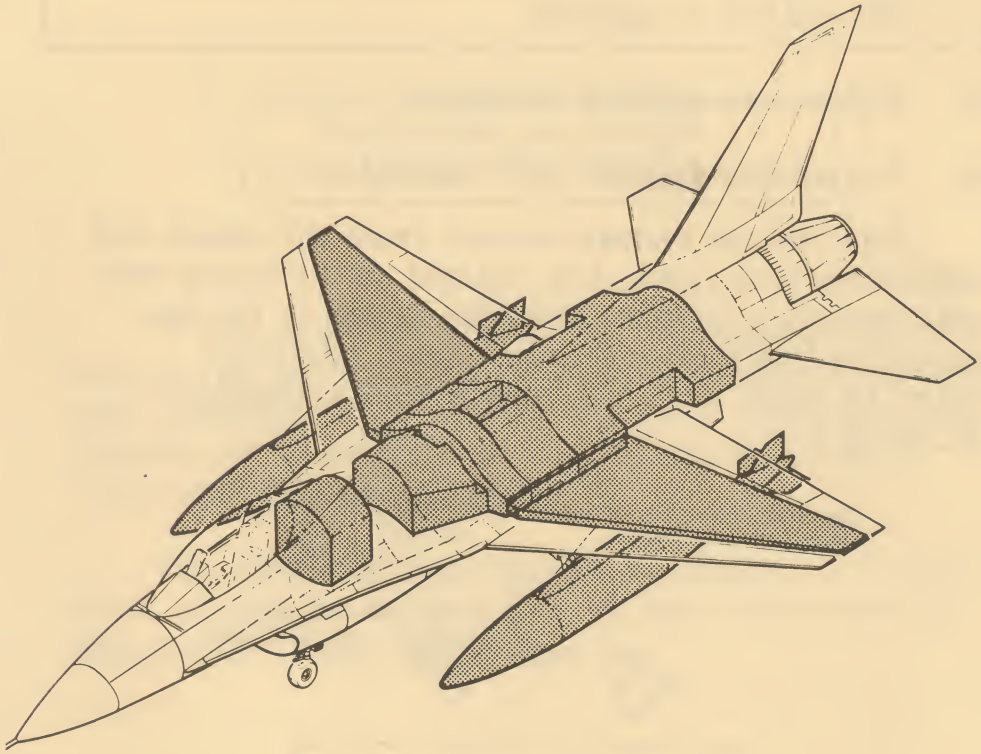
C10001 rivets may require special processing to obtain oversize replacement. Make the first installation perfect.

TF16Z-0145

Figure 22. C10001 Rivet - Fuel Sealing

Integral-fuel-tank construction requires application of special sealants and other precautions before riveting. Refer to fuel-tank sealing specifications, planning cards and training manual before riveting in these assemblies.

Many areas on the aircraft are required to be watertight. Refer to non-fuel-tank sealing specifications, planning cards and training manual.



TF16Z-0146

Figure 23. Riveting Integral Fuel Tanks (Sheet 1)

Integral fuel tanks have been designed with a multiple-barrier sealing system in which several sealant barriers are used to prevent fuel leakage. These are the barriers:

1. Faying surfaces are sealed.

2. Grooves in the faying surfaces are sealed.

3. Voids are sealed.

4. Fasteners are installed with wet sealant. Development of your skill in riveting is required when wet sealant is applied.

5. Fillets are applied on seams.

6. Fillets are applied over fasteners.

Remove the excess sealant from the shank end before bucking rivet. Any sealant on the shank end will provide a cushion from the action of the bar, resulting in a defective upset head. (Refer to FZM-12-4933, FPS 1004 and Process Standard 42.01.01.)

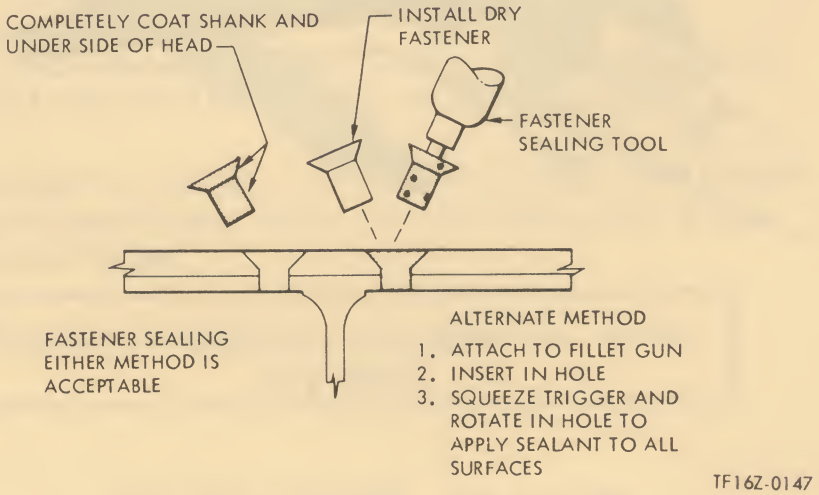
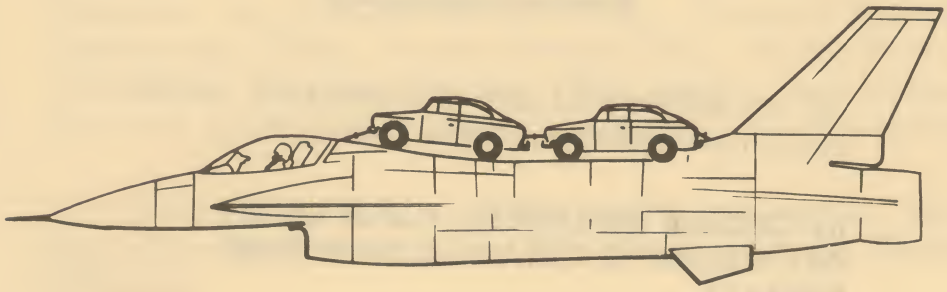


Figure 23. Riveting Integral Fuel Tanks (Sheet 2)

Smoothness on exterior surfaces of supersonic aircraft is extremely important. The penalties for even the slightest mismatch are very severe.

For instance, if no surface roughness on the aircraft exceeds specification tolerance (a near perfect job) the drag on the aircraft at supersonic speed will be the equivalent to the weight of two medium-size automobiles (6600 pounds).



TF16Z-0148

The amount that a rivet may protrude above the surface varies with each aircraft and surface location.

> For limitations and permissible conditions, refer to engineering specifications for surface smoothness, process standards and planning cards.

Rivets cannot be shaved if they protrude too far above the surface, or the head diameter will be too small.

Figure 24. Rivet Milling (Sheet 1)

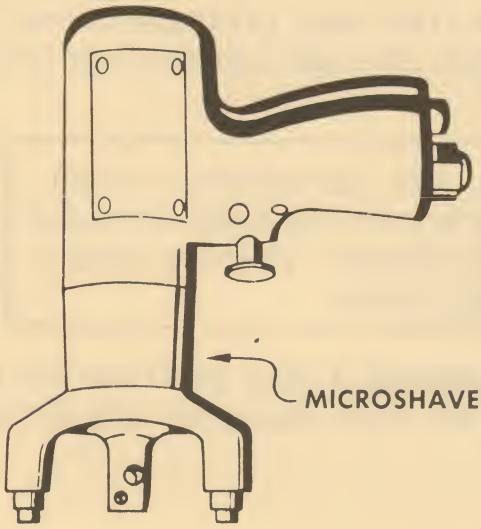
Rivet shaving is accomplished with an air-driven, high-speed cutter called a microrivet shaver.

Adjustment is the same as for a stop countersink. Allow the motor to reach top speed; check and adjust on scrap material. Recheck the adjustment, and secure the locking nut before using on assemblies.

SAFETY FIRST

Do not attempt to use microshaver without sufficient operating instructions.

IN CERTAIN INSTANCES, FLUSH RIVETS ARE MILLED TO OBTAIN A SMOOTHER SURFACE.



CAUTION: Adjust microshaver on scrap material - never on the aircraft or part.

TF16Z-0149

Figure 24. Rivet Milling (Sheet 2)

BLIND RIVETING:

Riveting is visually limited in many areas during aircraft construction. Often the bucker can only feel the rivet, or a long bucking bar is required. This kind of riveting requires much skill to hold the bar square and prevent damage to the structure.

Team work and the correct bar is essential for these situations. The first rivet must be a good rivet since subsequent attempts will be more difficult.

1. Safety equipment is designed and furnished for your protection. Use it.

2. Know the hazards of your job. Know how to do your job safely.

3. Notify your foreman of unsafe working conditions.

Figure 25. Safety

We have an obligation to our company and to our armed services to furnish them with the best and most modern equipment possible. Let's not let them down.

TF16Z-0151

Figure 26. An Obligation